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**APPLICATION
OF PATENT OF INVENTION**

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(54) **Process and apparatus for fixing a sheet to a receiving surface by means of adhesive.**

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The present invention relates to a process and an apparatus for fixing a sheet to a receiving surface by means of adhesive, this sheet and receiving surface, during or after the application of adhesive to a sheet and/or to a receiving surface, being pressed together along a line moving from one edge of the sheet to the other.

There are several processes for applying a sheet to a receiving surface. One of the most known case is the application of wall paper to a wall, sheets on which adhesive was applied being vertically placed side-by-side. According to another known process, sheets carrying printed advertising on one side, have a self-adhesive layer on the other side, this self-adhesive layer being covered with silicone paper, and being applied for advertising purpose by removing first the silicone paper. Sheets of this type are also known for covering objects of all kind in order to give them another color, or carrying drawing or inscription. Sheets made of synthetic material or paper are also fitted with a non-active adhesive layer which can be activated with heat and becomes sticky by this fact. For industrial applications, it is known how to move a receiving surface forward, for example the surface of a panel, in the same time with the sheet between two rollers with which the sheet is pressed onto the receiving surface.

Beside this industrial application, all above-mentioned applications are manually performed. The application of these sheets is labor intensive, and difficulty increases with sheet size and when these sheets must be applied to non-horizontal surfaces, for example vehicle vertical walls. Until now, maximal size allowing one to manually applying a sheet to vertical surfaces, in the case of sheets having previously received a self-adhesive layer, is 1 x 1 m. Particularly, it is the case of application of advertising on vehicles. Application of these sheets without kinks and with a correct junction of sheets is difficult. Naturally, it is known that applying wall-paper having

60 to 80 cm wide to a vertical wall. Due to small width and due to the fact that sheets are vertically applied, these sheets may be manipulated, and as the applied adhesive does not immediately and definitely adhere, errors may be corrected by removing the sheet and re-applying it. This operation is helped by the fact that sheets are paper based and become flexible and supple because of water contained in the adhesive. Moreover, not so large pleats disappear during the adhesive drying and therefore from the paper sheet. Similar conditions exist in the case of posters applied to an advertising column.

However, when large sheets must be applied to difficult surfaces, it is practically impossible to perform this operation by hand, particularly when sheets are made of synthetic resin with a self-adhesive layer or when synthetic resin sheets must receive beforehand an adhesive layer, particularly when these adhesive layers have high resistance. These self-adhesive layers have the characteristic of firmly adhering to any object in contact, such that correction of errors is extremely difficult. Until the present time, it was impossible to apply large size sheets without any error, and it is completely impossible to apply sheets with horizontal length of several meters without error and rapidly.

However, it is found that to apply the sheets, particularly to large surfaces of delivery trucks and containers, these surfaces being actually able to receive inscriptions only in spray-paint shops, operation which however requires several days to several weeks.

The present invention subject is a process and an apparatus allowing one to apply sheets having any size without having defects to any surface, regardless the position or the surface profile, and also permitting one to perform this operation to non completely smooth or flat surfaces because of ribs, rivets, profile parts or other configurations.

In general, this operation is obtained from the fact that, immediately before the application line, with a joint movement with this line and practically over the entire length of the line, a

negative pressure is established such that the sheets are pressed onto the receiving surface by atmospheric pressure. By establishing negative pressure at the described location and by moving this negative pressure jointly with the application line, it is possible to obtain, at the location where the sheet is in contact with the receiving surface, the atmospheric pressure which exerts an uniform pressure which certainly can not be established by hand nor with rollers, particularly when the receiving surface is flexible or unequal. In the event that receiving surface is permeable, negative pressure may be established on the back side of the receiving surface, i.e., the opposite side of the surface to which the sheet must be applied. That may be the case for vehicle canvasses.

When the receiving surface is impermeable, this is the most current case, negative pressure is established between the sheet and the receiving surface, and particularly in a narrow zone whose width is directed to the longest side of the sheet. This negative pressure or suction occurs in a region immediately before the location where the sheet touches the receiving surface, such that atmospheric pressure acting on the other side of the sheet correctly applies the sheet.

In compliance with the invention, it is useful to heat the receiving surface and/or the sheet. Particularly, it is the case with a sheet dilating with heat and therefore partly shrinks after fixation to a cold receiving surface and by this fact the sheet is correctly stretched. It also is particularly useful when the sheet is made of thermoplastic resin, because the sheet then becomes flexible due to heat and may adapt itself to irregularities of the receiving surface and even to profile forms of this surface. Moreover, heat may be used to activate a normally non-sticky adhesive.

Preferably, heating is performed at the location of the moving line and/or just before this line. This heating may be done with an air jet or with radiation heating.

Negative pressure may be obtained by means of a dust aspirator and hot air from the air exiting from the aspirator.

Apparatus according to the invention, in general, comprises a suction opening in the form of a slot with means for guiding this suction opening above the receiving surface and with an

apparatus for supporting the sheet feeding reel and for guiding the sheet from the reel to the suction opening, this suction opening being in a position immediately above the receiving surface while being directed toward the area where the sheet comes in contact with the receiving surface. This apparatus may be used with any position of the receiving surface, and during the sheet application to the receiving surface this suction opening may be moved over the receiving surface or the receiving surface may be moved with respect to the suction opening.

The apparatus may comprise a heating device for heating the sheet at an area located between the sheet arrival point and the suction opening and therefore before the sheet comes in contact with the receiving surface. Preferably, heating is extended well beyond the area where the sheet is already in contact with the receiving surface. Guiding device may have any suitable form.

If the receiving surface profile extends in the moving direction for applying the sheet, the apparatus preferably comprises a profiled guiding plate located between feeding reel and suction opening and in the area of the heating device. In this way, the sheet will automatically adapt itself to the profile. This profiled plate may be removable such that an apparatus being fitted with a flat guiding plate located between feeding reel and suction opening or slot can easily be converted into an apparatus for applying a sheet to a profiled receiving surface. The connection for the arrival of hot compressed air is preferably located in front of the guiding plate to help adapting the synthetic sheet to the guiding plate shape. In the case of difficult surfaces, for example vertical surfaces, the suction slot is preferably hung to a guiding element comprising a device for mounting this element to the object to be treated and allowing one to move the suction slot on a pre-determined path. In the case of vehicles, such as trucks or containers, guiding chassis is preferably in the form of a cart or more precisely a chassis fitted with four wheels capable of rolling on the vehicle upper part. This cart may be of simple construction with elements which can be adjusted to the width

of the vehicle upper part.

According to the invention, it is advantageous to fit the cart with a guiding bar parallel to the cart moving direction, this bar having a length longer than that of the cart, and the suction slot together with the feeding reel which can jointly be moved according to the longitudinal direction of the bar. This bar being longer than that of the cart, suction slot can operate over the entire vehicle length due to the fact that this suction slot may be moved beyond the wheels supported by the vehicle upper part.

Suction slot may be hung so that it can be rotated around a horizontal axle. However, suction slot is preferably guided with horizontal forks of a chassis hung to the guiding bar, these forks being perpendicular to the moving plane of the suction slot, and this plane being parallel to the cart moving direction. Suction slot will be then always at the same distance from the receiving surface, and during the operation it will apply itself with suction against this surface. That fact allows an automatic adaptation to the profiles or irregularities which vertically extend themselves, this adaptation which can be improved by fitting the suction slot with flexible mouthpiece.

However, it is also possible to obtain the adaptation to irregularities or profiles by fitting the suction slot with a flexible mouthpiece, suction slot position being fixed with respect to the receiving surface or it can be rotated around an axle parallel to the receiving surface and transverse with respect to the moving line.

According to the invention, guiding element may also comprise a support structure having guiding bar for the suction slot. This support structure may comprise elements which can be fixed to the object to be treated to form a structure mounted next to the object. Preferably, suction slot is fitted with a device for braking the sheet, for example, in the form of spring blades and a brake acting on the feeding reel to assure that the sheet is kept stretched.

Characteristics of the invention will show up more particularly from the following description, given out as example with reference made to annexed drawings, wherein:

- figure 1 is a schematic perspective view of the apparatus according to the invention and one part of the vehicle comprising the receiving surface,
- figure 2 is a schematic horizontal cross-section of the apparatus in figure 1,
- figure 3 a horizontal cross-section corresponding to that of figure 2 for a lightly modified apparatus according to the invention,
- figures 4 and 5 are schematic top view and side view of the back side of the apparatus according to an embodiment of the invention,
- figure 6 is a corresponding cross-section to that of figure 2 for an apparatus according to the invention comprising flexible suction slot,
- figure 7 is a cross-section corresponding to that of figure 2 with removable profiled guiding plate according to an embodiment of the invention,
- figure 8 is a cross-section along the line VIII-VIII of figure 7,
- figures 9 and 10 are schematic side view and top view of a simple manually operated apparatus according to an embodiment of the invention, and
- figure 11 is a part of an apparatus similar to that of figure 10 according to another embodiment of the invention.

Figure 1 shows the upper part of vehicle 1 and the way according to which advertising sheet 2 is applied over the entire length of one side of the vehicle surface. This application is performed with apparatus 3 schematically shown in cross-section in figure 2, this apparatus comprising, in general, chamber 4 connected to suction source 6 with hose 5 such as a dust aspirator, and chamber 7 and a reel of sheet 3 carried by support 9. Chamber 7 comprises an entrance opening or slot 10, an outlet 11 and a wall with window 12 which can be opened, for example, by pivoting around hinge 13. Chambers 7 and 4 are separated from each other by wall

14 forming a guiding surface for the sheet, this wall 14 jointly forms with lateral wall 11 a suction slot 16. This suction slot is located just before the location 17 to which sheet 18 was already applied to the receiving surface. The sheet travels from reel 8 to the guiding surface 14 and under spring blades 19 which keeps the sheet stretched.

Hot air may be sent to chamber 7 through hose 20 from the dust aspirator 6.

As it is shown in figure 1, apparatus 3 is hung to a cart 21 schematically shown in figure 1, this cart which can be moved on the upper surface of vehicle 1.

If hot air is sent through hose 20, exhausting opening 11 (figure 2) is preferably larger than slot 10 for the sheet arrival so that a large part of hot air flows on the sheet part already applied to the receiving surface.

Figure 3 shows a variation of the apparatus in figure 2. This variation being designed for applying sheets already have self-adhesive layer covered with silicone paper.

In this apparatus, wall or guiding surface 14 is replaced with two guiding plates 22 and 23, plate 22 delimiting suction slot 16 and guiding plate 23 which is articulated at 24 and fitted with roller 25 at its lower edge which can rotate freely. Surface or guiding plate 23 is in sealing contact with roller 25.

In this apparatus, the sheet carrying silicone paper is guided on plate 23 and the separated silicone paper 26 travels over roller 25 to be recovered in reel 27. To start the apparatus, the window is raised in the direction indicated by arrow 28 around hinge 13. Then, plate 23 carrying roller 25 is swung to the outside in the direction indicated by arrow 29 such that the sheet carrying silicone paper can be placed around roller 25 with separation of the silicone paper from the sheet with a length sufficient to allow one to introduce the silicone paper end into reel 27. To avoid

difficulty resulting from non-protected initial part of the sheet, this part being self-adhesive, it is coated with a product preventing the adherence, for example, a soap solution. This part is then cut and discarded.

When plate 23 is brought back to the position shown in figure 3, the initial non-covered and non-sticky part of the sheet is guided through slot 11 to the outside. Then, the sheet is pulled outward until an edge is bonded, after that the apparatus may completely be started by moving chamber 4 along receiving surface 1 with simultaneous reeling of the paper onto reel 27.

It is possible to replace roller 25 with a bar or another mobile element placed between plates 22 and 23, this bar being raised to place the sheet around the bar, and after the fixation of the paper end to reel 27 which is brought back to a lower position and being locked in this position. The above mentioned problem relating to the initial part of the sheet is no longer exists in this case. It is sufficient to make sure, at a suitable distance from the end, that the paper comprises a weakening line allowing one to tear the initial part.

Figures 4 and 5 show more in detail a cart according to an embodiment of the invention, this cart being schematically shown in 21 of figure 1. This cart comprises two almost equal halves of chassis 30 and 31 forming a rectangular assembly which can be adjusted to desired width using screws 32, both parts of the cart which can be separated by removing screws 32 to facilitate the transport of these parts. Each half of the chassis comprises axles 33 with wheels 34, preferably having a supple coating and a flange for guiding the wheel on the vehicle 1 upper edge. These axles also carry the outer end of guiding bar 35 longer than the cart.

Chassis 37 is hung to the guiding bar with its folded back upper ends to form capping 36 for wheels 38 rolling on guiding bar 35. Chassis vertical parts are assembled with horizontal bars 39 and carry rods 41 which guide the apparatus shown in one of the figures 2 and 3. Lower end of chassis 37 has wheel 40 to support the chassis on the receiving surface, these wheels which

could adjustably be mounted to assure that chassis 37 is moving, while being exactly in parallel to the receiving surface 1.

The guiding on transverse rods 41 allows one to perform all preparatory operations to take into consideration irregularities and profile of the receiving wall. During the operation, apparatus 3 is pressed against the receiving wall as soon as the sealing joint indicated in 42 in figures 2 and 3, reached the receiving surface.

If the receiving wall has a profiled form extending across the moving direction, suction slot is preferably fitted with elastic lips 43 and 44 as indicated in figure 6, lip 43 forming a shutter. The profile may be followed by the fact that entire chamber 4 may slide on guiding rods 41 or can be pivoted around an axle such as the one indicated in 45.

If the profile extends in the moving direction, it is preferably to use a profile guiding plate such as the one shown in 46 of figure 7, profile of this plate being, for example, the one indicated in figure 8. This profiled plate allows one to put the sheet in form beforehand when a radiating heating source 47 is mounted before the guiding plate 46.

Figures 9 and 10 show the use of the invention for a simple hand-held apparatus, and in fact for an apparatus for applying a sheet to a receiving surface on which adhesive was applied beforehand. This apparatus comprises a sucking nozzle 50 fixed at the end of hose 51 of a dust aspirator, this nozzle comprising on its enlarged part, a guiding piece 53 which can be fitted with a feeding reel 55 carried by supports 54. The apparatus is fitted with handles 56 for handling.

Figure 11 is a variation of the apparatus in figures 9 and 10 modified for applying a sheet having self-adhesive layer protected with silicone paper. This apparatus differs from the one in figure 9 by the fact that roller 55 is mounted by the side of exhausted end of the nozzle to guide

the return of silicone paper 58 removed from the rod front end. Return roller 57 for the silicone paper is mounted very close to the front edge of the nozzle mouthpiece such that a sufficient sealing is obtained at this location. During this apparatus operation, silicone paper 58 is torn by hand.

Naturally, above description is not limiting and the invention may be used according to other variations, without exiting from its scope.

CLAIMS

1. Process for fixing a sheet to a receiving surface by means of adhesive, according to which, after the application of adhesive either to the sheet or to the receiving surface, or to both, the sheet and the receiving surface are pressed to each other along a line moving from one end of the sheet to the other end, characterized by establishing immediately before the pressure line and by moving with this pressure line of a suction practically over the entire length of the line, in order that the sheet is pressed to the receiving surface with atmospheric pressure.
2. Process according to claim 1, characterized by the establishment of suction between the sheet and the receiving surface.
3. Process according to claim 1 or 2, characterized by the fact that the suction is established in a small area whose width corresponds to the length of the line.
4. Process according to any one of claims 1 to 3, characterized by the heating either of the sheet, or the receiving surface, or both, before their application to each other.
5. Process according to claim 4, characterized by the heating of the sheet either at the location of the line, or immediately before this line, or at the line location and immediately before the line.
6. Process according to claim 5, characterized by the heating by means of hot air flow.
7. Process according to claim 5, characterized by the heating with radiating heat.
8. Process according to any one of claim 1 to 7, characterized by the application of the sheet to a vertical or almost vertical surface in the line direction.
9. Process according to any one of claims 1 to 8, characterized by the application of the sheet to a curved or profiled surface in the line direction.

10. Process according to any one of claims 1 to 9, characterized by the fact that the sheet carries a self-adhesive layer covered with protective removable sheet which is continuously removed just before the suction opening.

11. Item characterized by the fact that it carries a sheet applied with the process according to any one of claims 1 to 10.

12. Apparatus for the use of a process according to any one of claims 1 to 10, characterized by a suction opening in the form of a slot having a device for supporting a feeding reel and for guiding the sheet until the suction slot, this suction slot being in a position wherein it is immediately close to the receiving surface and being directed toward the area where the sheet comes in contact with the receiving surface.

13. Apparatus according to claim 12, particularly for the use according to any one of claims 4 to 7, characterized by a heating device for heating the sheet at a location situated between the feeding reel and the suction slot.

14. Apparatus according to claim 13, characterized by the fact that heating device is placed such to be able to heat the sheet part already in contact with the receiving surface beyond the suction opening.

15. Apparatus according to claim 13 or 14, particularly for the use of a process according to claim 9, characterized by a profiled guiding plate for guiding the sheet, this guiding plate, viewed in the sheet moving forward direction, being mounted before the suction opening.

16. Apparatus according to claim 15, characterized by the fact that profiled plate is removable.

17. Apparatus according to any one of claims 13 to 16, characterized by a device for sending hot compressed air to the guiding plate.

18. Apparatus according to any one of claims 12 to 17, particularly for the use of the process according to claims 8 and 9, characterized by the fact that suction opening is hung to a guiding element comprising a device for mounting it to the object to be treated and by which the suction opening may be moved in a pre-determined direction.

19. Apparatus according to claim 18, characterized by the fact that guiding element is a cart.

20. Apparatus according to claim 18, characterized by the fact that guiding element is a structure having guiding bar to guide the suction opening.

21. Apparatus according to claim 19, characterized by the fact that the cart carries a guiding bar parallel to the cart moving direction, this bar being longer than the cart and suction opening as well as the feeding reel being hung to this bar and which can be moved in the bar longitudinal direction.

23. Apparatus according to any one of claims 12 to 22, characterized by a device located before the suction opening for braking the sheet.

24. Apparatus according to any one of claims 12 to 23, characterized by a flexible mouthpiece fitted on the suction opening.

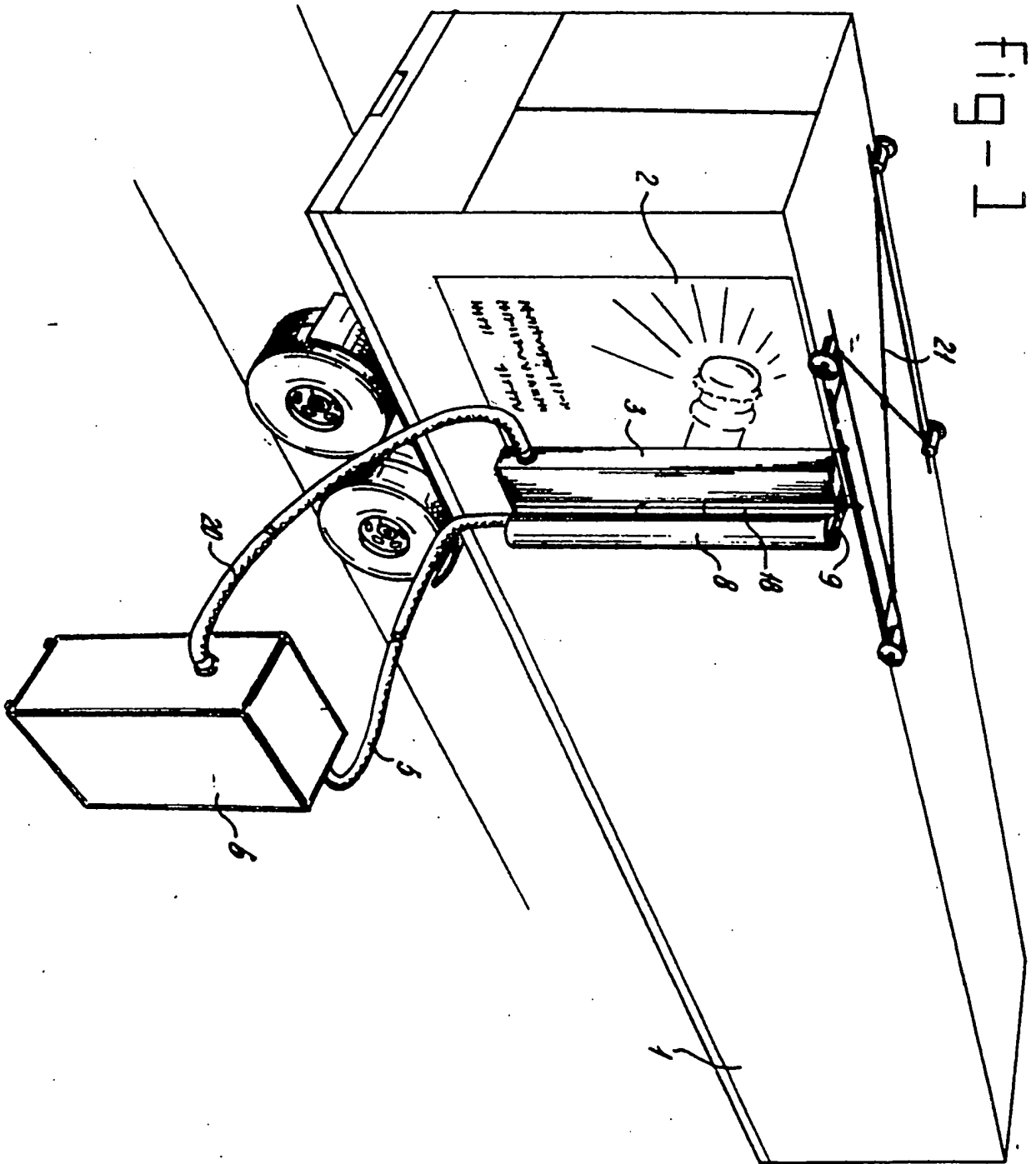


fig-2

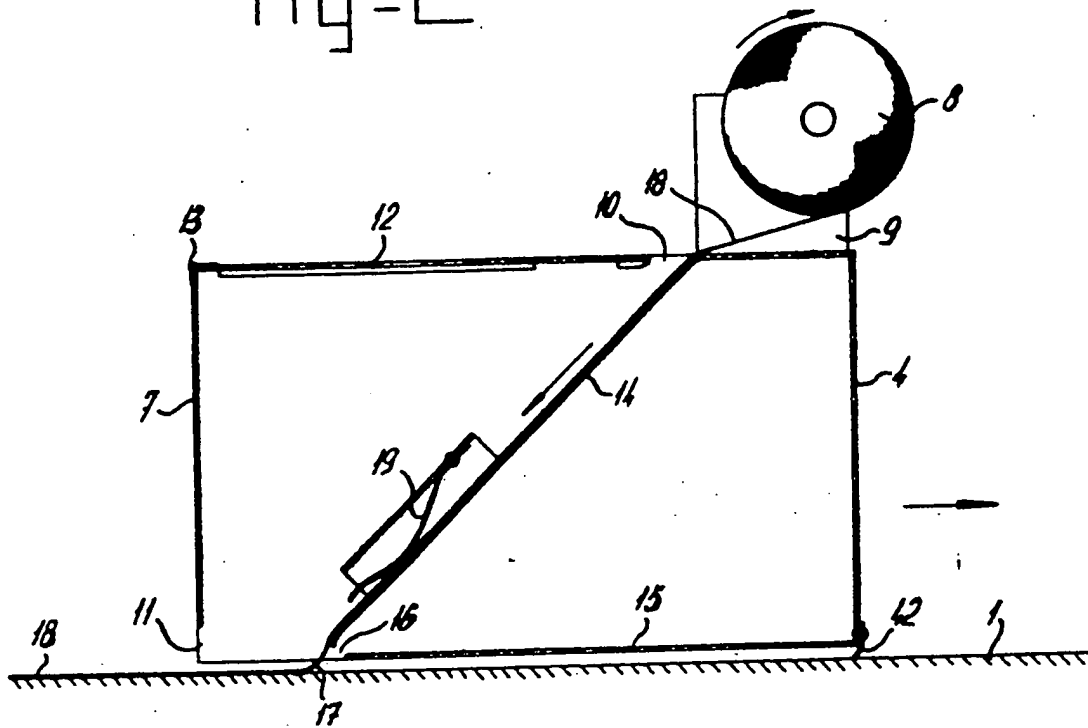


fig-3

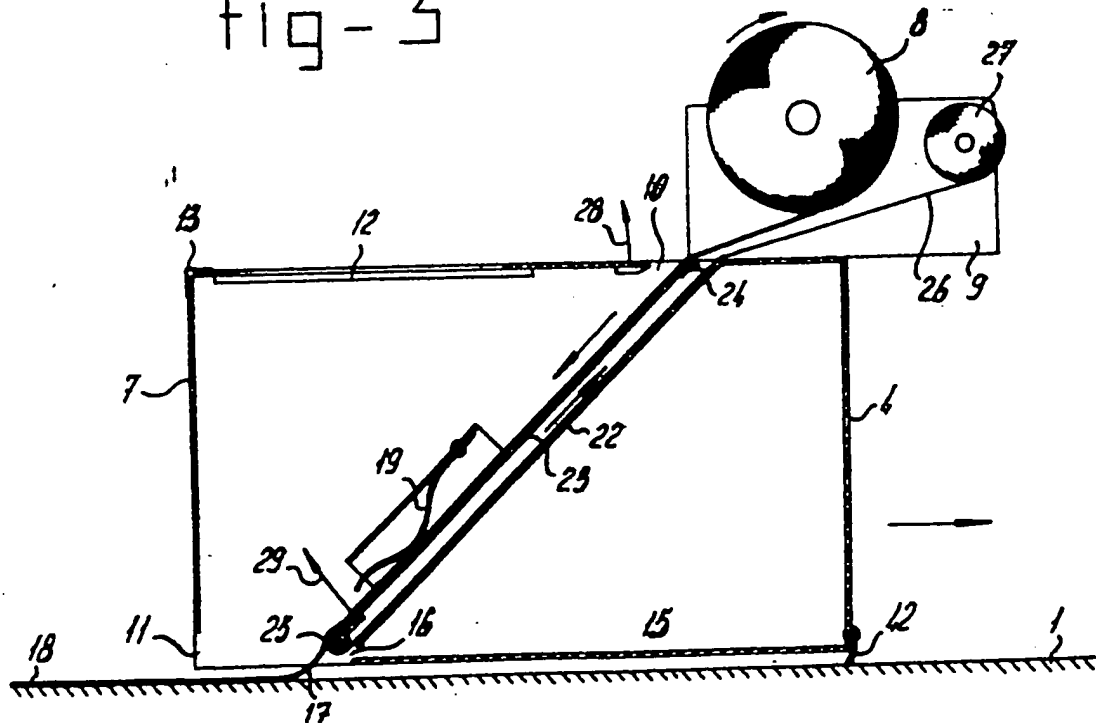


fig-4

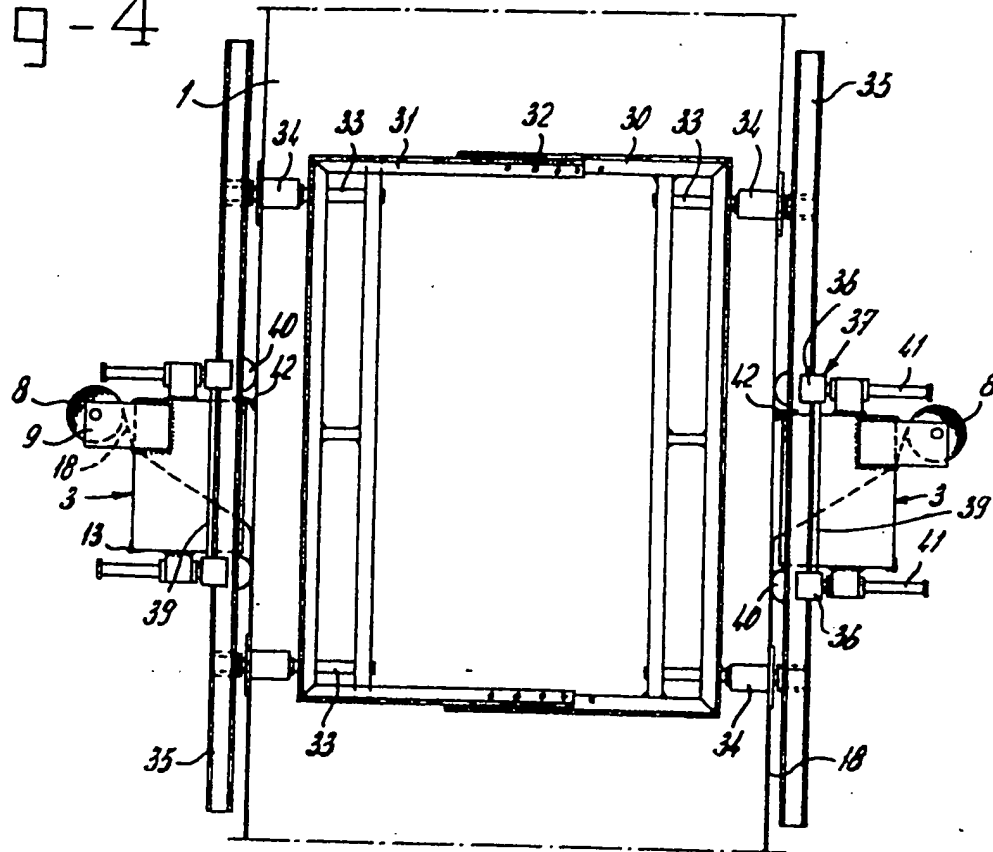


fig-5

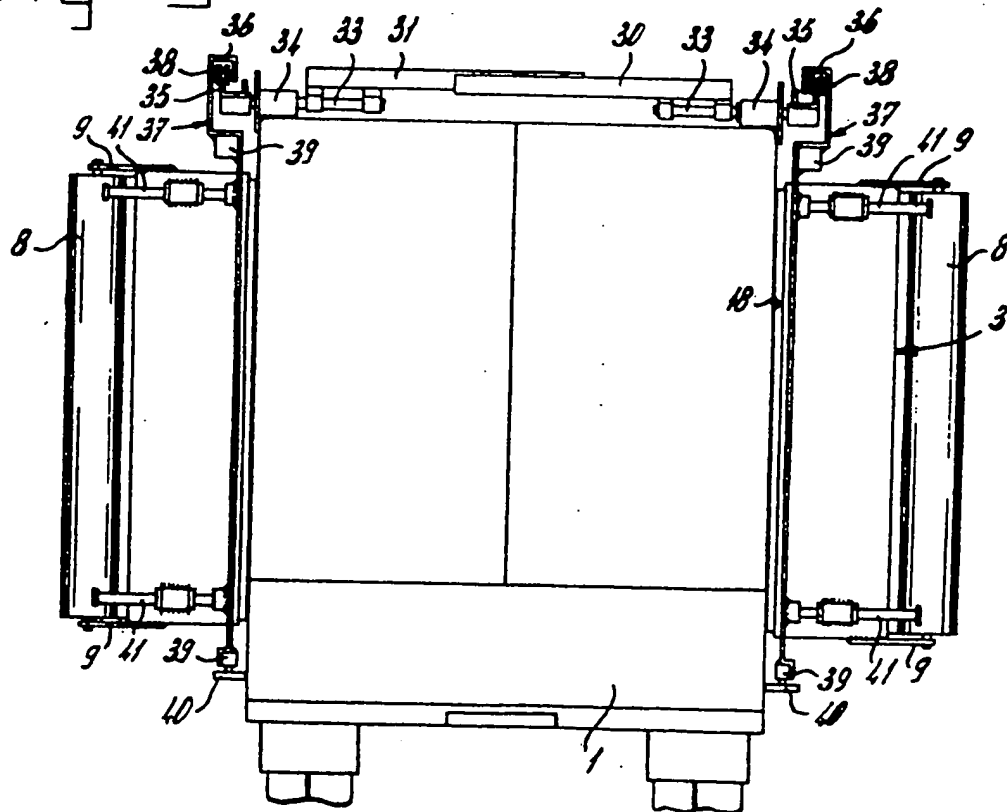


fig-6

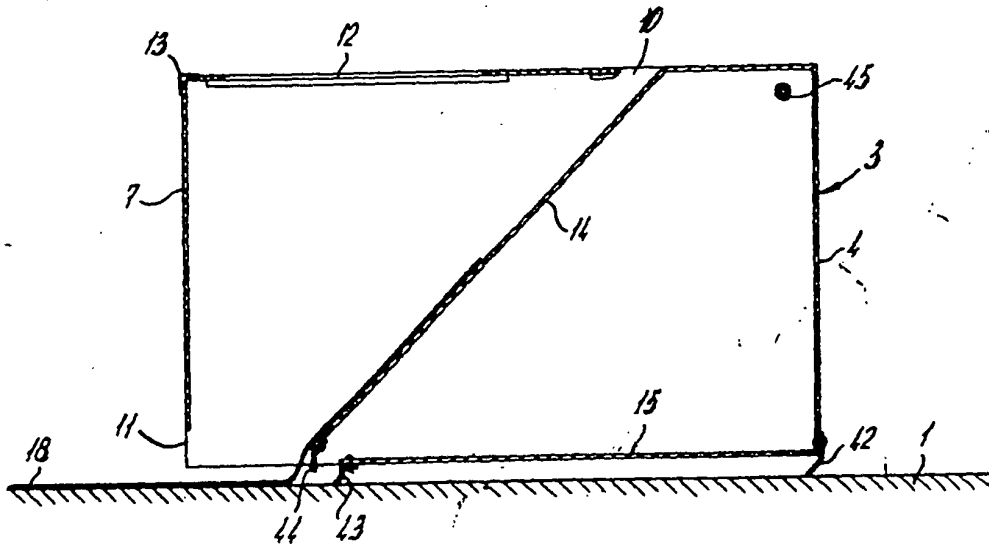


fig-7

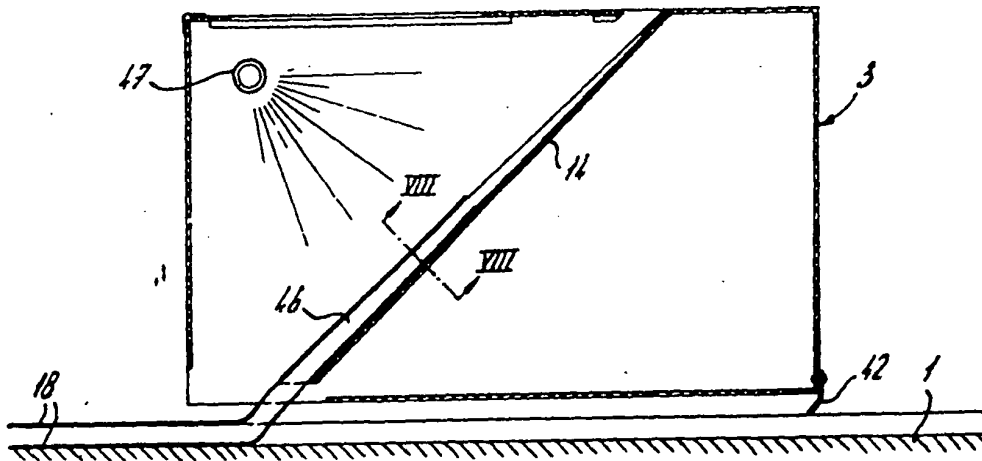


fig-8

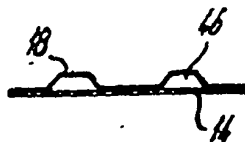


fig-9

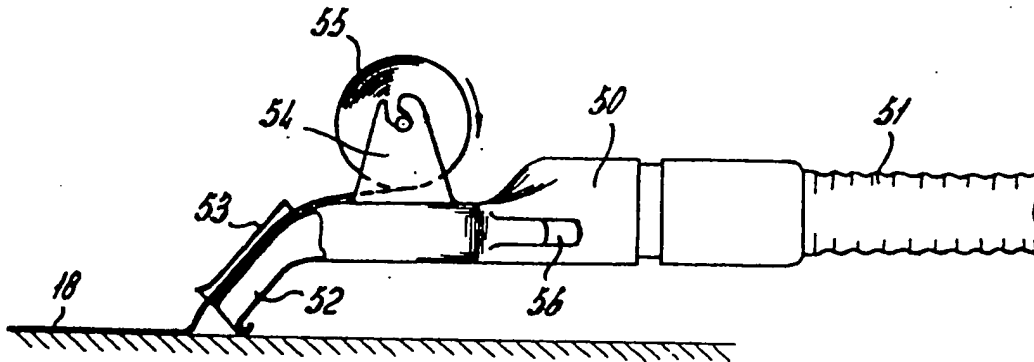


fig-10

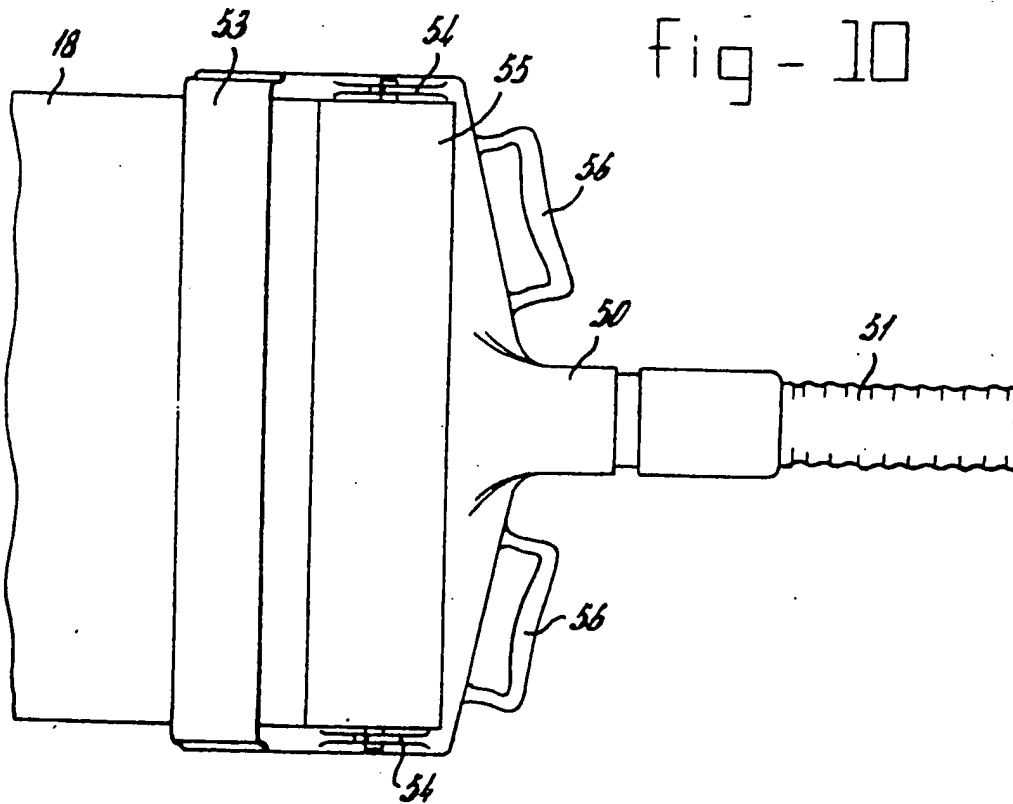


fig-11

